Seeds and statistics at tell Shiyukh Tahtani, Syria

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ABSTRACT
This paper outlines initial findings from the analysis of charred macrofossils found during excavations of Early and Middle Bronze Age levels at Tell Shiyukh Tahtani, Syria. The plant remains are statistically calculated in terms of variables or ratios in order to assess their 'routes of entry'. It is surmised that differences between the two periods suggest changes in the way the crop was harvest, stored and used.

Keywords:
Charred macrofossils, Bronze Age, Syria.

RESUM
Aquest article descriu els resultats inicials de l'anàlisi de macrofossils carbonitzats trobats durant les excavacions de la primrera i mitjana i edat del Bronze als nivells a dir Shiyukh Tahtani, Síria. Les restes vegetals són estadísticament calculades en termes de variables o ràtios per tal d'avaluar les seves "rutes d'entrada". Es dedueix que les diferències entre els dos períodes suggereixen canvis en la manera en què la collita va ser collida, emmagatzemada i usada.

Paraules Clau:
Macrofossils carbonitzats, Edat del Bronze, Síria.

1. Introduction

This paper is based on the analysis of a Bronze Age assemblage from Tell Shiyukh Tahtani, Syria. This formed the basis of the author's MSc dissertation (Gilligan 2010). The macrofossils retrieved from seven samples were first identified. Statistical calculation was then carried out, using the ratios of relative frequencies of cereal, chaff and weed, in order to determine the origin of the samples or the 'routes of entry' (van der Veen 2007). The paper is presented as an overview rather than an in-depth discussion as additional analysis is ongoing.

2. Tell Shiyukh Tahtani

The site of Tell Shiyukh Tahtani (Tall Šiyuḫ Taḥtānī) is located south of the Turkish border (Falsone 1995:37) on the eastern bank of the Euphrates River (Sconzo 2007:268; Falsone 1998:24). It consists of a conical mound which is

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17m in height and surrounded on three sides by a Lower Town. The entire site spans 6 hectares and excavations have yielded evidence for thirteen distinctive phases of activity representing almost continuous occupation from the Early Bronze Age to the Ottoman period.

*View of Tell Shi*yukh Tahtani showing a modern water-tower on the top (after Falsone and Sconzo 2009).

The location of Shiyukh Tahtani (After Anastasio et al. 2004)

The samples which are the subject of this paper were gathered during excavations of Early Bronze Age and Middle Bronze Age deposits. Four of the samples were taken from the Early Bronze Age levels, which primarily consisted of domestic architecture; features included an oven, bin and a floor. The three samples retrieved from the Middle Bronze Age level were taken from a storeroom and a floor.

3. Principles of Archaeobotany

This paper is based upon the principles of scientific analysis and interpretation of archaeobotanical remains. The identification of each fragment possible and assessment of the origin of each context makes it easier to ask questions of the data to enable a better understanding of the socio-cultural and economic practises which may have governed the tell (van der Veen 1992, 2007).

Most archaeobotanical assemblages have been created by people through their regular interaction with plants. The latter become preserved by charring, waterlogging or desiccation; this study was concerned with a charred assemblage.

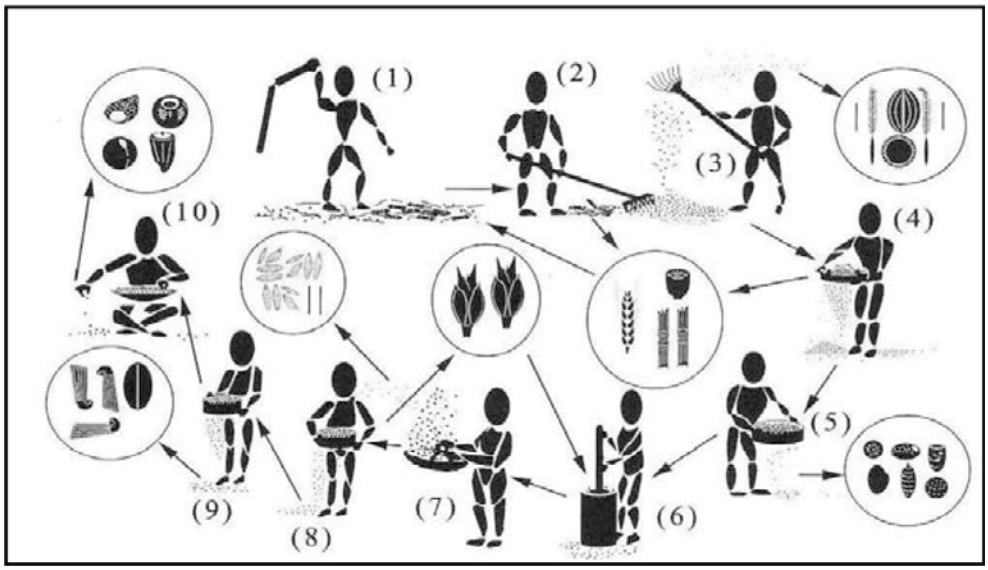
It is important that *'routes of entry'* be identified in order to assess the potential of the data (Hillman 1981; Jones 1987a and b; van der Veen 1992). The most common '*routes of entry'* of seeds and chaff into archaeological fe-

atures include food processing, preparation, consumption and storage as well as through fuel, animal dung, building materials and ritual (van der Veen 2007; Matthews 2009). Inevitably, most assemblages have been built up during a series of activities and are thus secondary in nature (Schiffer 1976; Hubbard and Clapham 1992).

Primarily, seeds which have been charred are retrieved from ovens, bins and floors, where their processing or preparation entailed the use of a fire. Interpretation is thus biased towards the preservation of plants that require fire for processing and preparation or those which become accidently charred (Miller 1990:75) Typically, as Knörzer (1971 in Fuller, McClatchie and Stevens in press) noted, the most common components of an assemblage then are cereal crops, chaff and weed seeds. It must be remembered that the macrofossils identified within an assemblage represent a very small part of the plant world which the inhabitants of the Tell would have known and utilised.

4. Theory and Methods of Archaeobotanical Analysis

Initial identifications of the assemblage were made using a variety of literary and digital sources, including Jacomet et al. (2006), Van Zeist and Bakker-Heeres (1985), Nesbitt (2006) and Zohary and Hopf (1994). These aided in the general assignation of the seeds to families and, in some cases, to genera. Further in-depth identification was then carried out with particular emphasis on comparisons with the reference collections in the Institute of Archaeology. The second part of the study focussed on the analysis of the identified seeds; the method of analysis incorporated the studies of Hillman (1981), (Jones (1987a), van der Veen (2007) and van der Veen and Jones (2006). The basis of this method was ethnobotanical information which Hillman and Jones gleaned from studying traditional agricultural societies and their means of harvesting, crop-processing and subsequent storage of crops. The studies revealed that these activities incorporated a number of steps and that each step could be tracked in the archaeological record by the relative frequency of grain, weeds and chaff present. The main steps comprise: 1) threshing/winnowing, 2) coarse sieving and 3) fine sieving. The by-products of the stages, as well as the resultant clean grain at the end of the process, are those plants and parts which are likely to come into contact with fire through fuel stores, parching, routine processing and accidents (van der Veen 1992:81). They are therefore the most likely parts to become preserved and discovered during excavation and sampling.



Crop-processing steps and the by-products which form archaeobotanical assemblages (after Stevens 2003:63)

By understanding the stages and plotting the assemblage against each stage in the form of the statistical analysis of relative taxa frequencies, it should be possible to infer how a society organised harvesting and how their crops were stored (Fuller et al. in press). This has important implications for societal organisation, scheduling of labour and risk-management strategies. This theory has been further reworked by Stevens (2003), van der Veen and Jones (2006) and Reddy (1997), among others. The method of statistical analysis used in this paper is directly based on van der Veen and Jones (2006).

5. Initial Identification and Analysis

• Early Bronze Age oven

Two of the samples (**396** and **401**) were retrieved from an Early Bronze Age oven, which was located in a domestic courtyard. The charred macrofossils identified were those of cereal grain, weed seeds and chaff. Cereal and chaff species included *Hordeum* sp. (barley; probably 2-row), *Triticum monococcum* (einkorn), Tr. *dicoccum* (emmer) and Tr. *durum* (durum wheat). The rare '*striate/sturdy emmeroid*' wheat was also present, in spikelet form (Jones et al. 2000; Fuller 2009:37).

Two grains of possible *Secale cereal* (rye) were noted in the assemblage; although there is evidence in the Near East of this crop being cultivated (Hillman 2000:392), it was probably more of a persistent field-weed (Zohary and Hopf 1994:72). Similarly, *Aegilops* sp. (goat-faced grass) is typically treated as a weed in archaeobotanical assemblages. However, here it is found in almost the same relative proportion as that of

barley and its sturdiness, similar size and appearance of the chaff and grain to the latter suggests that it may have been used in the Near East for more than is currently understood (Moulins *pers. comm.* 2010.). Small Fabaceae such as *Trigonella* sp. and *Astragalus* sp. were also present, as well as weedy Poaceae species which included Festuca sp. and *Taeniatherum* sp. (Nesbitt 2006). *Vitis vinifera* (grape), *Brassica* sp. (mustard) and *Capparis* sp. (capers) were also noted.

• Early Bronze Age bin

The charred contents of a bin (**397**), which was located in the same courtyard as the oven, contained varying proportions of seeds, weeds and chaff from the oven contents. Large Poaceae weed seeds dominated the assemblage and there was a large number of glumes and spikelets of goat-faced grass present.

There was a small amount of charred barley caryopses, but only three barley rachises were identified. Glume wheats included emmer and the new '*striate/sturdy emmeroid*'. Wheat chaff was almost triple that of the grain and there was a number of culms and culm nodes present.

Grape pips were identified; as were fragments of *Vicia/Lathyrus/Pisum* sp. (vetch/sweet pea/pea). Some of these species are recognised as crops in their own right; however, it is not clear whether vetch was a crop-plant or weed at this time (van Zeist and Bakker-Heeres 1985:309). There were also a large number of smaller legumes, such as *Medicago* sp. and *Trigonella* sp.

• Early and Middle Bronze Age Floors

Two samples were retrieved from floor samples. **Floor 1** (402) was associated with the Early Bronze Age, while **Floor 2** (412) was located in the Middle Bronze Age levels. They differed greatly in composition and rate of deposition. While **Floor 1** was sub-sampled due to the large variety visible during initial scanning, **Floor 2** yielded only thirty-nine seeds.

Cereal grain and weed counts were found in similar numbers in **Floor 1**; they made up more than half of the total assemblage. There were three times more barley grain than chaff in this sample, but this may be a preservation bias. Emmer and '*striate/sturdy emmeroid'spikelet* forks were found. Free-threshing bread wheat grains and a minimal amount of rachises were identified. Weedy Poaceae species included *Festuca* sp. *Bromus* sp. and *Eremopyrum* sp., which are generally suggestive of disturbed ground and crop fields (Nesbitt 2006). Goat-faced grass were also present here in both chaff and grain form

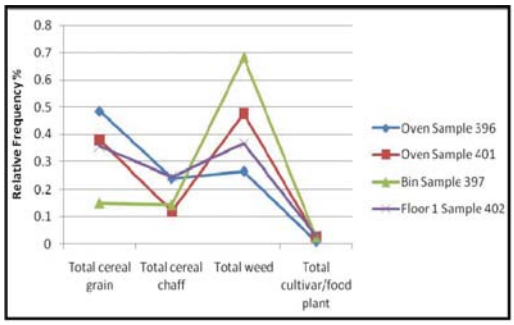
Large Fabaceae species were noted in

greater quantities than in the oven or bin contexts. Cultivated pea was identified; the other fragments were too charred to identify beyond the *Vicia/Lathyrus/Pisum* sp. grouping. Mustard, *Papaver* sp. (poppy) and *Rubus* sp. were also present. Other seeds noted included *Valerianella* sp. (corn-salad) and *Galium* sp. (bedstraw)

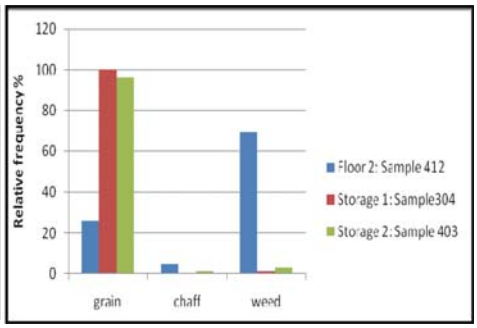
The sample retrieved from Middle Bronze Age **Floor 2** was dominated by weeds, with minimal taxa varieties. There were low frequencies of barley and there was no wheat present in grain or chaff form.

Possible edible food-plants were present in the form of bedstraw and *Rumex* sp. (docks) Dennell (1976) considered *Galium aparnine* (cleavers) to be of economic importance and also suggested similar evidence for the use of *Rumex crispus* (curly/yellow) as a stored crop and minor component of wheat, barley and legume crops.

There were only a small number of weeds present, which mainly comprised small legumes, such as *Trigonella* sp. and *Medicago* sp. A single grain of rye was probably also a weed.



Relative frequencies of components within EBA samples



Relative frequencies of components within MBA samples

• Middle Bronze Age Store Room

One sample taken from the Middle Bronze Age storeroom (Storage 1) comprised only fully cleaned grains of barley grains, while the second (Storage 2) contained 96% clean grain.

There no other weed seeds, cereals or chaff associated with **Storage 1** apart from barley and it is probably a primary context (Schiffer 1976; Hubbard and Clapham 1992).

Storage 2 contained two asymmetrical barley caryopses, although intense fire may have caused this distortion. There was only one rachis fragment noted. One emmer grain and glume were also identified. There were a few culm nodes within the sample also. A mini-

mal amount of goat-faced grass seeds and chaff were present.

6. Secondary Analysis: '*Routes of Entry*'

The samples were retrieved from spatially and temporally varying contexts. In order to make meaningful comparisons between samples it is necessary to understanding how the sample was formed. There are a number of considerations to take into account, which include understanding whether the layer was of a primary or secondary formation (Hubbard and Schiffer 1976; Hubbard and Clapham 1992), understanding the rate of deposition, differential preservation between plant parts and hulled and naked varieties (Boardman and Jones 1990) over-representation of taxa with many seeds.

The method used in this study for understanding the '*route of entry*' of the macrofossils is based upon a tables presented by van der Veen and Jones (2006:223). Essentially, the contents of the samples from Shiyukh Tahtani have been calculated as ratios in order to determine the '*mode of entry*'.

Preparation for the analysis included the division of the indeterminate cereals by the ratio of wheat and barley in the samples and the addition of these to each genus accordingly (van der Veen 1992:82). Wheat grains were dominated by emmer and therefore emmer, '*striate/sturdy emmeroid*' and einkorn were counted together. Barley was treated as a free-threshing species as it behaves in a similar manner to free-threshing wheats during processing (Hillman 1981). The glume base ratio in the table below is based upon the actual plant parts, as wheat spikelets are made up of two glumes and two grains, therefore the ratio is 2:2 or 1.

The results of the analysis can be seen in the table below.

	Sample variable	Sample origin		Sample Numbers							
		High value	Low value		396	397	401	402	412	304	403
				Ratio							
A	Cereal straw nodes/grains	By-product from early processing stage	Grain product		0.04	0.24	0.71	0.45	0	0	0.008
B	Free-threshing rachis internodes/ grains	By-product from early processing stage	Grain product	Tr.	0.72	0.63	0.75	0.72	0	0	0.33
				Hor.	2.96	0.04	0	0.1	0.33	0	0.003
C	Glume wheat glume bases/grains	By-product from late processing stage	Grain product		0.06	0.81	1.05	0.7	0	0	0.33
D	Weed seeds/cereal grains	By-product from late processing stage	Grain product		0.55	1.25	4.5	1.02	2.7	0	0.05
E	Small/large weed seeds	By-product from sieving	Product from sieving or by-product of hand cleaning		0	0.26	0.006	0.08	0.33	0	0
F	Number of crop items/1 l of deposit or number of ids/1 l of deposit	Rapid/single deposition	Slow/repeated deposition		17.92	18.6	14.87	19.8	0.97	1.5	8.95
G	Number of germinated/ non-germinated grains	(accident/deliberate conflagration) Cleaning of storage pit or malting residue	(usually day-to-day activity) Accidental grain spoilage		n/a	n/a	n/a	n/a	n/a	n/a	n/a
H	Number of diseased or insect damaged/ 'normal' grains	Deliberate burning of spoiled grain	Accidental grain spoilage		n/a	n/a	n/a	n/a	n/a	n/a	n/a

(After Van der Veen and Jones (2006:223)

Overview of the Results of 'Routes of Entry' Analysis

This is only an overview of the results of the analysis as work is on-going. The '*routes of entry*' analysis indicates the differences between the origins of each sample.

• Early Bronze Age

The samples from the Early Bronze Age (**396-402**) were extremely mixed and demonstrated various 'routes of entry'. The rate of deposition in these samples reflects a build-up over time indicating routine processes. The oven samples (396 and 401) contained by-products from early processing stages, including culm nodes and rachis internodes, as well as the spikelets, glume bases and large weed seeds which indicate later processing stages.

It can be suggested that the waste from threshing and winnowing was gathered and used to fuel the ovens; alternatively, the grains were stored after being semi-processed and were then routinely cleaned in the court-

yard when needed, with the waste being discarded into the fire. The level of crop-processing carried out at the time of harvest would probably have been determined by the amount of people available. In this case, it would suggest that harvesting was carried out on a small scale for domestic use, suggesting low levels of societal organisation or control. This was compounded by the fact that the samples also contained waste from later processing stages, which indicates that final cleaning also took place in the courtyard.

There was a high level of wheat rachis as compared to grains; however there were more barley grains and chaff present. It was probably the case that barley was consumed more frequently than wheat as the latter was a harder grain to grow and was probably viewed as more of a commodity.

The content of the sample retrieved from the bin (**397**) is similar to those from the oven. It comprised a mixture of both early and late crop-processing waste, in the form of cereal straw nodes, rachis internodes (mainly wheat), glume wheat bases and weeds. This assemblage contained the highest ratio of small to large weed seeds among the Early Bronze Age samples. While bins are often considered to be storage items in Syrian Tells, it seems likely that this feature was used to hold discarded waste from processing and fire rake-outs. This is the likeliest way that charred chaff, weeds and grains from all stages of processing were found here.

The sample from Floor 1 (**402**) differed to that of the previous samples. There was a variety of species found here, but a large amount was made up by barley and wheat grain and chaff. It would appear therefore that grain was stored in this room in spikelets and hulls. There was evidence of early stages of processing, while the ratio of weed to grain present suggests that there was either accidental discard of weeds brought in with the harvest or that an initial phase of sieving was carried out here. The lack of large weed seeds suggested that final hand-sorting were carried out elsewhere; perhaps close to a domestic oven or fire.

The results of the analysis of these samples reflect the Early Bronze Age domestic contexts and settings. The grain appears to have been harvested by a small number of people, stored in its glumes and hulls and routinely processed beside the fire when needed. The processing waste was used as either fuel or was simply discarded into the fire. This indicates that the inhabitants of the Tell in this period were not communally harvesting or storing their grain, which suggests

that it may have been a loosely-organized domestic economy.

• Middle Bronze Age

However, the findings from the Middle Bronze Age samples indicate that the harvesting process and organization of the Tell may have changed significantly by this time.

The three samples (**304**, **403** and **412**) were formed extremely rapidly, through probable accidental conflagration. Storage 1 (**304**) contained barley grains only. These were processed elsewhere and stored here. The fire destroyed grains which were probably a valuable commodity and had been stored here for either strategic purposes in case of future bad harvests or for future trading.

Storage 2 (**403**) contained a minimal amount of processing waste. The latter comprised straw nodes, rachis internodes (mainly wheat), glume wheat bases and weed seeds. The larger and persistent goat-faced grass was present, suggesting that hand-sorting was carried out here.

The sample from Floor 2 (**412**) was also formed rapidly. There was only a minimal amount of processing waste present, albeit early and late stages were represented. A notable presence of goat-faced grass grains suggest that this may have been more commonly consumed than is currently believed. It may have been used to bulk up flours and animal feed and could have been purposely stored with the clean grain.

The analyses of the Middle Bronze Age samples suggest that there is a shift in crop-processing and storage from that of the Early Bronze Age. The predominantly clean grains indicate that crops were being processed to a greater extent than previously and in a different location to where they were stored. It suggests that there may have been greater mobilisation of people at harvest-time and that grains were perhaps communally stored in a fully-processed state rather than semi-processed which necessitated routine cleaning. The results could suggest a change from a domestic economy to one based upon a more organised hierarchy, who were thinking towards the future in both social and economic terms.

The contexts and general settings within which the samples were retrieved would also suggest similar conclusions. The Early Bronze Age levels consisted of domestic buildings with rectangular rooms and attached courtyards, while the Middle Bronze Age buildings were constructed along different axes and in a differing form. The former revealed domestic ovens and bins, while quernstones, storage

jars, rich furnishing and storage seals were found in the latter period.

7. Conclusions

Identification and analysis was carried out on seven samples retrieved from excavations in Tell Shiyukh Tahtani, Syria. The assemblages consisted of varying proportions of grains, chaff, weeds, oil and fruit-seeds.

The analysis sought to determine the '*routes of entry*' of each sample in order to understand the origins of the sample formation, as well as indicating comparisons or changes between contexts and periods.

Initial findings suggest that Early Bronze Age crops were semi-processed during the harvest and stored in spikelets. The grains were processed in the domestic courtyard when needed and the waste was discarded into the fire or bin. The samples retrieved from the Middle Bronze Age contexts suggest that a change had occurred in the way the inhabitants were processing and storing their grain. High numbers of almost fully clean grain suggests a more organised society, which mobilised for harvest and stored clean grains in centralized non-domestic rooms for future calamities or trading purposes.

Identification and analysis of additional samples is ongoing and therefore this is only an initial assessment.

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